IMPLEMENTATION OF MPLS TRAFFIC ENGINEERING WITH OSPF EXTENSION ON GNS3

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Abstract: At present situation, everyone wants a faster and good network for their esteemed works. Everyone wants a faster data rate with minimum delay. When we considering a large network like ISP`s network, they have to fulfill all the requirements of number of users and also solve the problems like congestion control, traffic flow, etc. MPLS which stands for Multi-Protocol Label Switching provides a way to manage these situations using TE (Traffic Engineering). This paper explains how MPLS TE improves the traffic flow in original network with routing protocol and utilize underutilize paths to manage heavy traffic. Along with MPLS TE, this uses OSPF (Open Shortest Path First) as the protocol and GNS3 to provide real time simulation-based environment.

Index Terms - **MPLS, OSPF, MPLS Traffic Engineering, Network.**

I. INTRODUCTION

 An ISP (Internet service provider)provides the customers access to the Internet and other familiar services. The ISP's covers a particular geographical area. Some ISPs have their own high-speed leased lines to provide good services to their customers, this help the ISP's to be less dependent on the telecommunication providers. But as the ISP`s contain a large network, they have the burden of this huge networks also. Due to these heavy network loads on ISP`s, latency is generated in their mechanisms, also throughput is affected. Hence, the overall performance decreases. So, there is a need of some technologies to overcome these things and enhance the performance parameters of the existing network, which can manage the heavy traffic in ISP's controlled networks.

     MPLS (Multi-Protocol Label Switching) is one of the trending technologies used by some ISP`s to overcome the drawbacks and improves the parameters of the network. It is a type of data carrying technique for high performance telecommunication networks. Traffic Engineering is one the important application of MPLS that can provide solution in case of heavy traff**ic.**

1.1   *Open Shortest Path First Protocol (OSPF)*

        OSPF is a widely used and supported interior gateway protocol (IGP). It uses link-state routing algorithm to forward the data packets in the network. OSPF calculates the shortest path through the network based on the cost of the route. The OSPF is a classless routing protocol & its Administrative Distance is 110.

1.2   *Multi-Protocol Label Switching (MPLS)*

        MPLS is basically a routing technique used in many networks to route the data. In this technique the packets are forwarded by label switching instead of IP switching. The MPLS labels are advertised between routers so that they can build a label-to-label mapping. It is often referred as layer 2.5 protocol as it considered to be working at a layer lies between data link layer (layer 2) & network layer (layer 3).
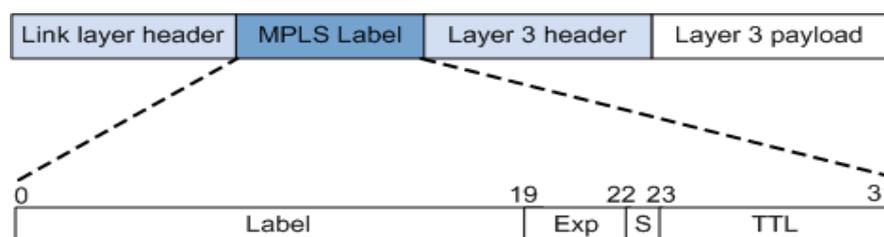

Fig (1). MPLS label format

1.3   MPLS Traffic Engineering

The basic idea of traffic engineering is to use the network infrastructure in the most favorable way, including links that are not utilized, because they do not lie on the preferred path. This means that the possibility to direct traffic through the network on the paths different from preferred path is created by traffic engineering. Traffic engineering in a MPLS network, provides efficient use of all links, available bandwidths and fast coverage in case of network failures.

1.4   Graphical Network Simulator (GNS3)

GNS3 is a network software emulator. A complex network simulation is allowed in GNS3 by making the use of virtual and real devices. GNS3 is used by many companies including NASA, AT&T Walmart etc. A real-time network simulation can be done for pre-deployment testing without any need of network hardware. GNS3 allows to run the OS that can mimic real behaviour of network hardware. GNS3 has customized topologies and labs for network certification training. Any real network can be connected to GNS3.

II. MOTIVATION

A large network contains thousands of routers which can be connected in very much complex manner. In this scenario, data packet or information has available number of paths to reach from source to particular destination. In this case, packets are transferred along the path assigned by the applied routing protocol. The routing protocol provides best suitable path by using their metric to reach the destination. But in this case, packets always follow the one prescribed path and there are chances that some paths remain unutilized. When packets are transferred along only one path, there may be huge congestion along that path which causes delay in packet transmission. At this situation, MPLS TE manage the traffic flow by utilizing the underutilized paths in the network and enhances performance parameters by reducing congestion. Hence, the whole network is utilized in balanced manner.
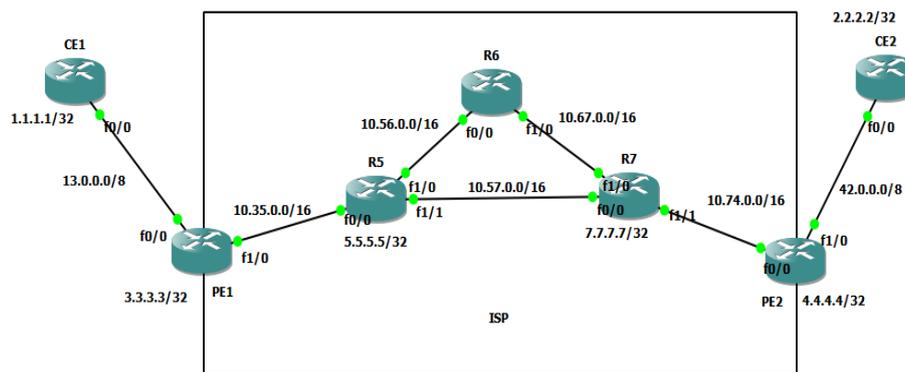
III. NETWORK DESIGN

Fig (2). Network design

The figure shows, the proposed network which uses the concept of MPLS TE. Consider, the rectangle as a large ISP network. CE1 and CE2 are the customer edge routers and PE1 and PE2 are the provider edge routers. As such it is ISP network, it contains thousands of networking devices connected in very much complex manner. Now, in this scenario, if CE1 wants to communicate with CE2, then we will see how packet transfer will take place in between these two when there are number of paths available for packet from source to destination.
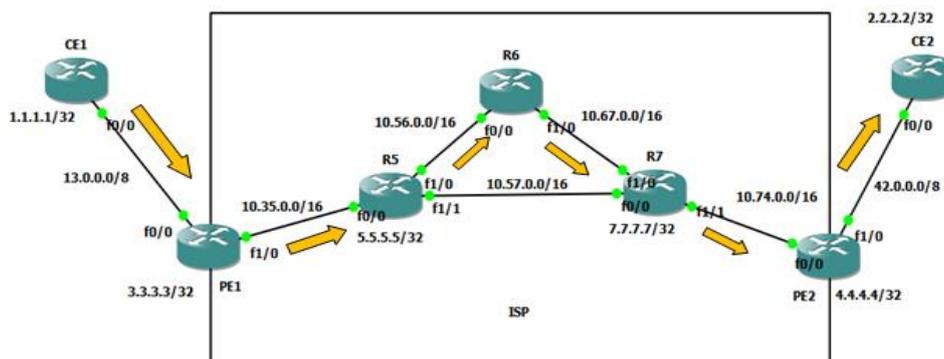
IV. COMPARATIVE ANALYSIS

Fig (3). Path taken by OSPF

The path followed by data through the network with OSPF routing policy is shown in fig (3). In this case, the packet find the best route on the basis of cost value of the available routes and uses reference bandwidth of 100 Mbps for calculation of cost.The packets from CE1 reach to router R5 through PE1, now here two paths are available for packet to reach to router R7. One is R5-R7 and other one is R5-R6-R7. As the cost of the link between routers R5 & R7 is maximum, data packets follows the path along R5-R6-R7. As a result of this, link between R5-R7 remains untilized all the time.
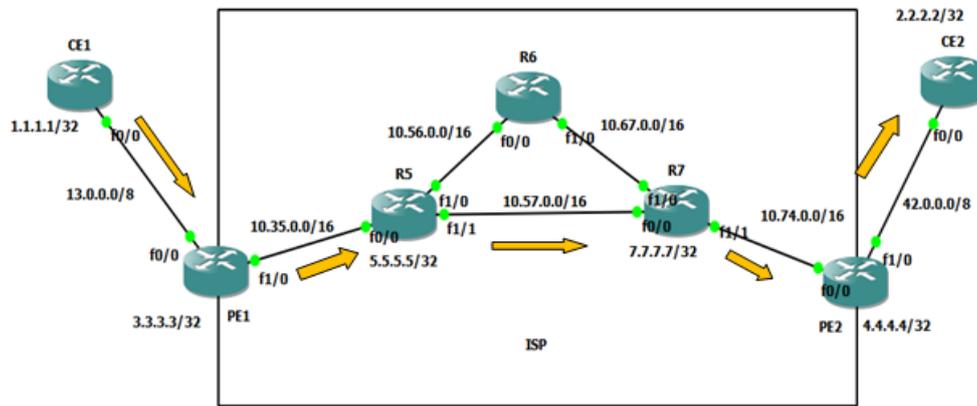

Fig (4). Path taken by MPLS TE

Above figure shows path followed by data packets in a network with MPLS traffic engineering.In case of OSPF, all packets transfer through R5-R6-R7 path so, there is huge burden of traffic along this path. Now to manage traffic and thereby enhance performance , MPLS TE is implemented in ISP's network.This willallow the data packets to travel through link between R5-R7 even if the cost is very high in case of heavy traffic or according to requirment of customers.
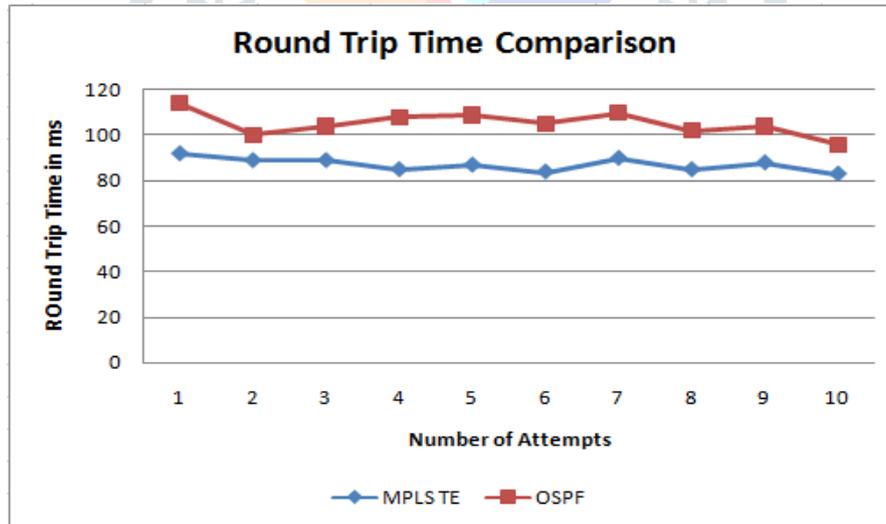

Fig (5). Comparison of round trip time

 The above figure compares performance of Traffic Engineering with OSPF routing protocol by considering the roundtrip time(RTT) i.e. time require to transfer the signal or packet at destination plus the time it takes for the acknowledgement of received packet. It is clear from the figure that MPLS TE is more efficient than OSPF routing protocol.

V. CONCLUSION

The major challenge for MPLS network to fulfill all the requirements for various services in limited resources. Simultaneously, it should also maintain the quality of service in terms of packet loss, delay. The MPLS TE, conveniently uses the underutilized paths in the large network and manages the traffic by reducing network congestion on one particular path. Hence, utilization of whole network resources is achieved in a balanced manner.

VI. ACKNOWLEDGEMENTS

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